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# USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 107

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19 July 1983

USSR REPORT  
ELECTRONICS AND ELECTRICAL ENGINEERING

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UDC: 522.2:523.164

TWO-CHANNEL RADIO TELESCOPE FOR STUDYING RADIO RADIATION OF THE ATMOSPHERE  
AND SEA SURFACE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian  
Vol 26, No 2, Feb 83 (manuscript received 12 Apr 82) pp 155-160

ZBOROVSKIY, V. S., LARIONOVA, L. F., PRIGODA, B. A., SAMOYLOV, R. A.,  
FEDYANTSEV, B. K. and KHRULEV, V. V., Scientific Research Radiophysical  
Institute

[Abstract] A two-channel radio telescope operating at  $\lambda = 0.8$  cm and 1.35 cm has been developed by the authors' institute in order to study the radio radiation of the atmosphere and the surface of the sea from onboard a scientific research vessel. The telescope is designed to use a narrowly directional antenna system with a half width at half power level of about  $1^\circ$ . The single reflector antenna is shielded by an absorbing screen eliminating direct entry of radio background radiation into the antenna. The plane of polarization of the antenna can be varied over  $360^\circ$ . The elevation of the antenna can be varied between  $-30$  and  $+90^\circ$ , azimuth around a full  $360^\circ$ . A drawing and a photograph of the radiotelescope are presented. Figures 6; tables 1; references: 3 Russian.  
[227-6508]

UDC: 535.31

PROPAGATION OF SPACE CHARGE WAVES OVER STATISTICALLY UNEVEN SURFACE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian  
Vol 26, No 2, Feb 83 (manuscript received 31 May 82) pp 214-219

BASS, F. G., BULGAKOV, A. A., KHANKINA, S. I. and YAKOVENKO, V. M., Institute  
of Radiophysics and Electronics, UkrSSSR Academy of Sciences

[Abstract] A study is presented of the interaction of space charge waves in streams passing over a statistically nonuniform solid surface. Dispersion equations are obtained in the hydrodynamic approximation, the spectra and decrements (or increments) of attenuation (increase) of natural oscillations are found. Tables 1; references 5: 4 Russian, 1 Western.  
[227-6508]

## IMPULSE REACTIONS OF CLOSED METAL SHIELDS

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian  
Vol 26, No 2, Feb 83 (manuscript received 23 Jun 82) pp 226-230

GRINBERG, Ya. R.

[Abstract] Based on the results of penetration of a monochromatic wave into cylindrical and spherical shields as determined in a 1975 work by the author; expressions are derived for the pulse reactions of these screens. The equations produced are approximate solutions for the entire time interval. The pulse reaction of the spherical shield is described by two parameters and one universal function. The monochromatic solutions used in finding the pulsed reactions were obtained on the assumption of quasi-stability. Figures 1; references 7: 4 Russian, 3 Western.  
[227-6508]

## DIFFRACTION OF ELECTROMAGNETIC WAVES ON FINE DIELECTRIC COMB AND ARRAY OF RECTANGULAR BARS

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 26,  
No 2, Feb 83 (manuscript received 5 Apr 82) pp 231-239

BOROVSKIY, I. V. and KHIZHNYAK, N. A., Kharkov State University

[Abstract] Analytic relationships are derived and studied for the diffraction of electromagnetic waves on periodic structures with narrow slots. The coefficients of reflection and transmission are determined by a new solution method. For a fine dielectric comb with H polarization at the incident waves there are incident angles at which the modulus of the reflection coefficient is independent of grid depth. For a fine dielectric lattice of rectangular bars resonant complete transmission is possible with both H and E polarization of the incident wave. Nonresonant transmission of a wave is possible only with H polarization. For a fine grid as the relative width of the slot decreases and dielectric permeability of the grid increases the angle of total nonresonant transmission increases, approaching  $90^\circ$  in the limiting case. Figures 2; references: 8 Russian.  
[227-6508]

## BASIC REGULARITIES OF CHANGE IN SELECTIVE PROPERTIES OF PERIODIC WAVEGUIDE-TYPE GRIDS

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 26, No 2, Feb 83 (manuscript received 4 May 82) pp 240-245

KUSAYKIN, A. P. and SIRENKO, Yu. K., Institute of Radiophysics and Electronics, UkrSSR Academy of Sciences

[Abstract] The results are presented from a study of certain resonant and anomalous conditions of scattering of planar E and H polarized waves by unidimensionally periodic waveguide type grids, i.e., grids the geometry of which includes a waveguide area of interaction with a regular section of nonzero length between zones of reflection and transmission. The two model geometries used in the study are semitransparent or reflecting grids with simple and complex structure of one period, with the waveguide channels separated by ideally conducting bars or blades. Figures 7; references: 8 Russian.  
[227-6508]

## PROPAGATION AND TRANSFORMATION OF SHORT RADIO WAVES IN MAGNETOSPHERIC WAVEGUIDE

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 26, No 2, Feb 83 (manuscript received 10 Jun 82) pp 142-147

BORISOV, N. D., Institute of Terrestrial Magnetism, The Ionosphere and Radio Wave Propagation, USSR Academy of Sciences

[Abstract] The cold plasma approximation is used to study the process of linear transformation arising in a magnetospheric resonator in the area of reflection of a wave from the ionosphere. A model of a flat wave channel extended along the z axis is used. It is assumed that the plasma concentration in each cross section has a local minimum sufficient to retain the wave within the waveguide. The concentration is also considered to change along the y axis and to increase adiabatically slowly along the z axis. The process of transformation studied in the work is rather effective if the point of intersection of the two branches lies near the area of propagation of the main wave. This situation arises in the vicinity of the reflection of an ordinary wave from the ionosphere. The corrections which might develop to the results produced when more precise equations are used are estimated. Figures 1; references 8: 7 Russian, 1 Western.  
[227-6508]

POSSIBLE CHANNELING OF LIGHT BEAM IN NONLINEAR MEDIUM WITH SPATIALLY  
HETEROGENEOUS AMPLIFICATION AND ABSORPTION

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 26,  
No 2, Feb 83 (manuscript received 17 Feb 82) pp 161-168

GINZBURG, N. S., MILOVSKIY, N. D. and RUSOV, N. Yu., Gorkiy State University

[Abstract] Compensated beams are found in active media with homogeneously and heterogeneously expanded luminescence lines, channeling of which occurs because of internal processes and a specially selected transverse distribution of linear absorption or concentration of active centers as a monochromatic electromagnetic beam propagates through a limitless active medium. The possibility in principle is noted of the existence of two-dimensional compensated beams in which the transverse field structure and velocity of phase front change in the direction of propagation. The results of the work can be useful for estimation of the parameters of beams propagating without additional phase correction in amplifiers with long active medium tracks for which the transverse distributions of active center concentration and linear absorption are known. Figures 5; tables 2; references 11: 9 Russian, 2 Western.  
[227-6508]

PARAMETERS OF RADIATING SLOT CUT IN NONRECIPROCAL WAVEGUIDE WALL

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 4, Apr 83  
(manuscript received 7 Dec 81) pp 669-675

ZAYTSEV, E. F., YAVON, Yu. P.

[Abstract] A study is made of the parameters of a slot cut in a nonreciprocal waveguide. This class of radiator, typified by a waveguide containing one or more ferrite plates, cannot be designed using the approximation of the radiating slot as a quadrupole contained in an equivalent transmission line. The solution is constructed on the basis of the known solutions for reciprocal slot systems, extending it to cover the case when the waveguide is not reciprocal. Because of the nonreciprocal nature of the waveguide, the radiated power varies with the direction of the exciter wave. The equations used were applied to the calculation of a longitudinal slot in the narrow wall of a rectangular waveguide with a ferrite plate against the opposite wall. Figures 4; references: 7 Russian.  
[235-6508]

## STATISTICAL EXTENDED TARGET COORDINATE ERROR MEASUREMENT CHARACTERISTICS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 4, Apr 83  
(manuscript received 27 Jul 81) pp 719-722

SHLYAKHIN, V. M.

[Abstract] Radar tracking of an extended target consisting of several individual targets or sources of secondary radiation involves a distance error and two angular errors resulting from drifting of the phase center of the complex target. A method is suggested for determining the measurement error characteristics by calculating the joint signal envelope distribution of the signal reflected from each individual target and the envelope of the resulting signal. The method is said to be less cumbersome and more accurate than the standard method of computing the distribution of the ratio of reflected signal envelopes and its transforms assuming uniform distribution of random phase difference. The new method allows many cumbersome intermediate transforms to be bypassed. References 12: 11 Russian, 1 Western.  
[235-6508]

## COUPLING OF HETEROGENEOUS TRANSMISSION LINE WAVE MATRIX ELEMENTS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 4, Apr 83  
(manuscript received 10 Feb 82) pp 797-799

SALIY, I. N., SALIY, S. A. and FEL'DSHEYN, A. L.

[Abstract] An earlier work showed that in the case of a reversible heterogeneous transmission line one need know only one element of the classical transmission matrix in order to find the other three. In practice normalized wave transmission and scattering matrices are usually used to describe heterogeneous transmission lines. Functional relationships are obtained in this article which relate all of the transmission and scattering matrix elements. This is made possible by additional couplings between transmission and scattering matrix elements, described in differential equations. References 4: 3 Russian, 1 Western.  
[235-6508]

## EXPERIMENTAL STUDY OF EDGE EFFECTS IN OPEN MILLIMETER BAND RESONATORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 4, Apr 83  
(manuscript received 16 Sep 81) pp 689-695

VERTIY, A. A., IVANCHENKO, I. V., POPENKO, N. A. and SHESTOPALOV, V. P.

[Abstract] A study is presented of the influence of edge effects on the spectral properties of a semi-symmetrical open resonator operating in the millimeter wave band. The spatial polarization structure of the resonant waveguide beam field is studied. The mechanism of development of depolarization effects in the resonator is analyzed by representing the current at an obstacle as the sum of the uniform and nonuniform parts of the surface current. The method allows the cross component of the edge wave field to be separated and its spatial distribution studied. Experimental determinations of the cross component are used to study its behavior as a function of various resonator parameters. Edge effects related to the diffraction of the resonant wave beam lead to a change in the polarization structure. It is shown that disturbance of the external resonant field leads to a change in the state of the polarization field within the resonator. Figures 5; references: 11 Russian, 1 Western.  
[235-6508]

## OPTIMAL FILTRATION IN MOVING OBJECT PARAMETER MEASUREMENT RADAR SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 4, Apr 83  
(manuscript received 11 May 81) pp 799-802

MEL'NIKOV, B. G.

[Abstract] Methods of optimal filtration of signals based on the minimum error dispersion are widely used and provide an effective unbiased estimate of current parameters. An earlier work has solved the problem of synthesizing a linear filter in a space of states, optimal based on the criterion of maximum probability that the measured parameter estimate vector will fall within a predefined area providing the optimal biased estimate. Other works have suggested nonlinear analogs of optimal filters adequate to radar tracking moving object parameter measuring systems. An analysis is presented of the results of these works, indicating that a nonlinear filter which is optimal based on the criterion of maximum probability that the estimate vector will fall in a predefined area, achieves a more correct consideration of a priori information on the regular component of the radar signal parameters estimated. This increases the accuracy and accelerates convergence of the filtration process. Figures 2; references 9: 8 Russian, 1 Western (in translation).  
[235-6508]

## USE OF TRUNCATED SEQUENTIAL PROCEDURES IN RADAR DETECTION PROBLEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 4, Apr 83  
(manuscript received 22 Jun 81) pp 696-702

SHATILOV, A. I.

[Abstract] A study is presented of the expediency of using truncated sequential procedures for radar problems. An optimal truncation procedure is used in each element of the solution, and the false alarm probability has a certain positive minimum limit. The results obtained in the numerical analysis of a particular example can be extended to more general problems. Two-stage sequential review procedures are the simplest and preferable in cases with small samples. They result in a significant energy gain in comparison with 1-stage procedures if the number of elements in the solution is not over 200. Figures 3; references: 6 Russian.  
[235-6508]

UDC: 621.396.677.49.001.24

## CALCULATING CHARACTERISTICS OF MULTICHANNEL RECEIVING ANTENNA SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 4, Apr 83  
(manuscript received 10 Jul 81) pp 703-708

RATYNSKIY, M. V., SHEKHOVTSEV, V. V. and BYCHIKHIN, Yu. Z.

[Abstract] A study is made of problems of determining the dynamic range of a multichannel receiving antenna system with a multistage addition system, based on the parameters of the elements. It is assumed that 1) All elements of the system are matched; 2) There is no mutual coupling between radiators; 3) The amplifiers have good valve properties; and 4) Signals are added in two stages. The transmission factors of the branches and the main line are different for the sections containing the adders. The sensitivity characteristics of a multichannel system can be calculated by equations presented in this article, using the transmission factors of the sections for independent noise under the assumptions outlined above. The analysis requires that two concepts be introduced: the local dynamic band and the integral dynamic band (adjusted to the output of the line). The results obtained can be extended to different numbers of stages of addition of the signals and to the case where the characteristics of elements at the same level are different. Figures 1; tables 4; references: 5 Russian.  
[235-6508]



UDC: 621.373

SET OF OPTIMAL CHARGE WAVES OF VIDEO PULSE GENERATOR SHAPER LINE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 4, Apr 83  
(manuscript received 21 Dec 81) pp 743-745

MESHKOV, A. N.

[Abstract] After the shaper section of the transmission line is charged and the switch to the load is closed a rectangular pulse is produced. The charge current is made quasi-steady by slowing the charge rate or connecting the source to several points on the line. Otherwise the pulse shape is distorted. A rapid pulsed charge producing clear wave processes is also of great interest. It can be produced using a large polar dielectric as a line insulator, greatly reducing line size, by using small magnetic distributed type switches to create effective solid state nanosecond high power pulse generators with repetition frequencies of tens of kilohertz. This article shows that a set of functions can be found to describe the shape of the charge current in this case, producing a regular rectangular pulse with pulse charging of the line. Rectangular video pulse 15 ns in length with a voltage of 50 kV and a power of 25 MW have been produced. These pulses are used to power the source of electrons for an accelerator. Figure 1; references: 7 Russian.  
[235-6508]

UDC: 621.397.037.372

INPUT OF SOURCE RECOGNITION CODE TO DIGITAL TV SIGNAL

Moscow TEKNIKA KINO I TELEVIDENIYA in Russian No 4, Apr 83 pp 37-39

LYAKHOVA, T. M. and ROMANKOV, L. P., All-Union Scientific Research Institute of Television

[Abstract] Fourth generation TV broadcast equipment requires transmission and processing of television signals in digital form. The introduction of a recognition code to a digital TV signal allows operating personnel to verify correct reception of the signal at the broadcast center. A four digit code is suggested, the first two digits being alphabetical and representing the type of equipment (camera, video tape recorder, motion picture or slide

projector) while the third and fourth digits are numeric and represent specifically which camera, recorder, projector or whatever is transmitting the signal. A structural diagram is presented of a device for formation and insertion of a recognition code into a digital video signal. The signal can be transmitted using one of the frequencies of the digital synchronization generator network. Structural diagrams of receiving and decoding devices are presented. Where large numbers of cameras and other signal sources must be connected to control room equipment, automatic digital recognition of proper connection can greatly facilitate operations. S. V. Pavlenko took part in tuning circuits. Figures 4.  
[233-6508]

UDC: 621.397.61:621.397.132

#### INFLUENCE OF DAYLIGHT COLOR TEMPERATURE ON TV CAMERA COLOR TRANSMISSION QUALITY

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 4, Apr 83 pp 43-47

BEZSHKURENKO, L. T. and KUL'YANOVA, V. I., All-Union Scientific Research Institute of Television and Radio Broadcasting

[Abstract] An analysis of the influence of color temperature on color transmission image quality is performed for the range of 4000-12,000 K, which is reported as the maximum variation in daylight color temperature. The data obtained allow determination of the range of necessary regulation of the blue and red channels in order to provide the required white balance throughout the range of color temperatures with constant current in the green channel. It is found that as color temperature changes from the minimum to the maximum, the signal in the R channel must be doubled, and that in the B channel divided by almost three. The use of optimal color correction matrices can provide good color transmission quality. Balancing to white practically eliminates the influence of source color temperature on color transmission quality. Figures 6; tables 2; references 6: 4 Russian, 2 Western (1 in translation).  
[233-6508]

UDC: 778.38:621.397.13

#### TRANSMISSION OF HOLOGRAPHIC IMAGE IN CLOSED CIRCUIT TV SYSTEM

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 4, Apr 83 pp 31-33

VOROB'YEV, S. P.

[Abstract] The development of specific holographic image transmission systems requires detailed analysis of the process by which the holographic image is read in the TV system and transmitted over the communications line. This

problem is studied here as applicable to holographic images of pages of scientific and technical documents. Fraunhofer holograms are used to record the documents. The finite dimensions of the holograms reduce resolution in comparison to the initial documents. However, this also allows the image restored from the hologram to be represented as a function of the spatial coordinates with a limited spectrum. Kotelnikov's theorem can be applied to the functions in order to optimize TV system resolution. Full restoration of the image occurs when a supplementary function, a set of sample values, is passed through a low-frequency filter which is transparent in a certain area and completely stops the signal outside the area. Although such an ideal filter cannot be implemented, the method of designing an approximating filter is described. The required TV bandwidth for transmission of holograms of scientific and technical text pages is calculated: for a 4 mm diameter hologram, a bandwidth of 21 MHz is needed. The approach outlined in the article for design of the low-pass filter and calculation of TV channel characteristics is suitable for both TV and laser image systems. Figures 1; references 11: 9 Russian, 2 Western in translation. [233-6508]

#### DEVICE FOR LEAD-IN OF TELEVISION PROGRAM

Moscow VESTNIK SVYAZI in Russian No 4, Apr 83 pp 32-34

GUTKIN, E. I., senior engineer, production laboratory of mechanical repair station, RMS-3, Rayon Management of River Transportation, UkSSR

[Abstract] A device has been developed and built for lead-in of television programs from the demodulator in a radio relay station to an RPTDA-type radio relay. The device consists of a video transmitter and an audio transmitter, with radio signals in each generated at the intermediate frequencies of 38 MHz and 31.5 MHz, respectively. These signals are combined in a passive summing circuit in a 5:1 - 10:1 ratio before they appear at the output. The composite output signal of 4-8 mV proceeds to an i-f amplifier. The inputs of this program lead-in device are designed for standard video and audio signals. Both i-f channels feature the use of strong negative feedback in their FM stages, through a 9.1 kohm resistor in the emitter circuit in the video channel and with a low-frequency signal in the audio channel. Negative feedback in the FM stage of the video channel eliminates the need for nonlinear correction. The modulation index here can be measured directly, by means of nonstandard measuring pulses, but this must be done prior to the broadcast so as not to disturb the operation of the flyback quencher. An instrument panel is provided for monitoring the frequency deviation of the FM audio oscillator as well changes in the nonlinear distortion factor and in the amplitude-frequency characteristic. There is also a monitoring demodulator installed in the RPTDA radio relay link which consists of a microwave detector inside the housing of a directional coupler and a low-pass filter. By the beginning of 1982 15 such devices had already been installed and put in operation at the RMS-3. Figures 6. [224-2415]

## SOUND SIGNAL ENVELOPE TRANSFORMATIONS

Moscow TEKHNIIKA KINO I TELEVIDENIYA in Russian No 4, Apr 83 pp 3-6

ISHUTKIN, Yu. M. and PLYUSHCHEV, V. M., Leningrad Institute of Cinematographic Engineers, "Screen" Scientific-Production Association

[Abstract] Using the example of a noninertial compressor, a study is made of the nonlinear transformation of the Hilbert envelope of a sound signal. This is of interest for transferring a signal from a magnetic medium to a photographic medium and in certain other cases. The hardware implementation of a noninertial compressor, which converts the envelope of the input complex signal to an output complex signal envelope in which the dynamic range is less, is illustrated and analyzed. Noninertial expanders and compressors are a new type of converter which may be used in different areas from more traditional devices such as autoregulators, including recording of percussion instruments without distorting their sound. Figures 6; references: 3 Russian. [233-6508]

UDC: 621.397.61] Videomarnitofon

## SELECTION OF MATERIAL, COATING AND PROCESSING OF VIDEO TAPE RECORDER GUIDE DRUM

Moscow TEKHNIIKA KINO I TELEVIDENIYA in Russian No 4, Apr 83 pp 47-50

KOROLEV, Yu. V.

[Abstract] A study is made of recommendations for selection of the optimal, most economical materials, coatings, type and quality of processing and design of the operating surface of a type A drum providing for a low coefficient of friction between tape and drum and thus increasing the service life of both tape and drum in a video tape recorder. The required service life with not over 0.015 mm wear of the drum must be at least 1500 hours, coefficient of friction not over 0.3, ratio of coefficient of friction at rest to coefficient of friction in motion not over 1.15. The selection of materials which can satisfy these demands as well as the requirement that the material be in abundant supply and inexpensive is limited. It is concluded that the best material and process combination is as follows: D16T alloy coated with N15 chemical coating, 105 mm in diameter, variation from cylindrical not over 0.005 mm, wear rate not over 0.01  $\mu\text{m/hr}$ , hardness HV500-700, coefficient of friction in motion not over 0.16, at rest not over 0.17, surface formed by turning. The "Elektronika" second generation VTR utilizes a drum which meets these requirements. Tables 2; references 26: 16 Russian, 10 Western (5 in translation). [233-6508]

UDC: 778.5:621.397.13

DEVELOPMENTAL TRENDS IN LASER IMAGE RECORDING DEVICES

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 4, Apr 83 pp 25-31

IOSIFOV, V. Ye.

[Abstract] The CBS and Rank laser video recording systems are briefly described. Subsequent developments including the NHK and RCA wideband laser color television recorders are also described in general terms. All of these devices utilize acousto-optical modulation of a gas or semiconductor laser beam in order to expose each color signal (total of 3) onto motion picture film (the RCA TLBR machine utilizes 3M 7869 film). The technology and means for correcting scanning distortions in laser television image recording systems are analyzed. The use of an electro-mechanical correction device with no color dispersion is preferable in recording color images. Figures 2; references 21: 9 Russian, 12 Western.  
[233-6508]

UDC: 681.846.7.004.68

'RITM-REPORTER' TAPE RECORDER MODERNIZED

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 4, Apr 83 pp 51-52

BYKOVSKIY, A. F., Sverdlovsk Motion Picture Studio

[Abstract] The workers of the sound recording shop of Sverdlovsk Motion Picture Studio have developed an improved version of the "Ritm-Reporter" (KZMP-7) magnetic tape recorder with a modernized battery power supply containing 12 NKG-1.5 batteries in order to allow 6 hours continuous operation, an automatic battery charger, and a modernized recording and reproduction system for the synchronization signal. Schematic diagrams are presented of the automatic charger and phantom and a capacitor microphone phantom power supply. Figures 2.

[233-6508]

## INFLUENCE OF ABERRATIONS ON OPTICAL FOURIER TRANSFORM QUALITY

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian  
Vol 28, No 2, Mar-Apr 83 (manuscript received 27 Nov 81; in final form  
18 Feb 82) pp 90-92

BELINSKIY, A. V., Moscow Institute of Geodesy, Aerial Photography and Cartography Engineers

[Abstract] A study is made of an optical Fourier transform considering aberrations and diffraction in the optical system. The specifics of the behavior of a function defining the quality spectrum of the system are examined using two examples, in one of which the Fourier transforming lens is a single element with only spherical aberration. In the second example the Fourier transforming lens is a multiple-element system in which fifth order aberrations must be considered. It is concluded that essentially the Fourier transforming lenses of the coherent spectral analyzers distort the spectra of three-dimensional frequencies only because of diffraction. The influence of aberrations is negligible. Figures 4; references: 4 Russian.  
[229-6508]

## USE OF LIGHT-EMITTING DIODES TO APPLY TIME MARKS IN HIGH SPEED CINEMATOGRAPHY

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian  
Vol 28, No 2, Mar-Apr 83 pp 149-155

KONOVALOV, N. A. and LAKHNO, N. I.

[Abstract] Light-emitting diodes are considered to be the most promising light sources for production of time marks in high speed cinematography. This review describes the electrical characteristics of contemporary LED's, their optical characteristics and the process involved in recording time information on motion picture film by the use of LED's. Diagrams of the spectral characteristics and light flux density as a function of input power are presented. The history of the use of LED's to record time information on motion picture film is briefly outlined, beginning with the work of Losev in 1923 and including American developments plus the electroluminescent head developed at the Leningrad Institute of Electrotechnology, using a silicon carbide active element to produce a brightness of  $50 \text{ cd/m}^2$ , allowing recording of images at the film speeds of 400 mm/s in the 0-20,000 Hz band. Photographs of the recording of electrical signals on light sensitive material by a silicon carbide diode are presented, including a combined recording of 1000 and 10,000 Hz signals. Figures 8; tables 2; references 24: 19 Russian, 5 Western (1 in translation).  
[229-6508]

# TENTH ANNIVERSARY OF 'ASSOFOTO' INTERNATIONAL ECONOMIC ORGANIZATION

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 4, Apr 83 pp 77-78

YEGER, B., General Director, "Wolfren" Photochemical Combine, and KOZLOV, Yu., Chief of the All-Union Association of the Chemical-Photographic Industry (Soyuzkhimfoto)

[Abstract] The 10th anniversary of the "Assofoto" international economic organizations was on 15 June 1983. This organization, which combines the photochemical industry of the USSR and East Germany, was created in response to resolutions of the communist parties of the two nations in order to improve socialist economic integration. Since its founding the cooperation between "Soyuzkhimfoto" and the "Wolfren" photochemical combine has been directed toward socialist division of labor and mutually helpful cooperation in order to concentrate scientific and technical potential, eliminating duplication and achieving efficient specialization and cooperation. East Germany has specialized in the production of double negative and double positive monochrome motion picture film, the USSR in the production of monochrome reversal films in super 8 cassettes, studio magnetic video tape and photographic papers, with both nations cooperating in the production of color reversal films in super 8 cassettes and audio magnetic tape. The workers of the photochemical industry of the USSR and East Germany can be proud of their international organization, created in the spirit of brotherly cooperation.  
[233-6508]

UDC: 621.37:519.22

## METHOD OF CONSTRUCTING ADAPTIVE FILTERS WITH LIMITED LEARNING SAMPLE VOLUME

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 4, Apr 83  
(manuscript received 10 Aug 81; after revision 28 Jun 82) pp 731-734

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LEVSHIN, V. P., STRUCHEV, V. F. and KHARITONOV, A. G.

[Abstract] There is broad interest in adaptive signal processing filters which utilize the criterion of maximum signal-to-noise ratio. In addition to stochastic gradient procedures, direct methods have recently been studied utilizing inversion of the noise correlation matrix obtained from a finite sample. In most cases the use of a regularized noise correlation matrix estimate can suppress noise where the volume of the learning sample is equal to the number of noise sources. A recursive procedure is suggested for adaptive signal processing which can decrease the computational cost to a figure proportional to the ratio of the number of signal samples to the volume of the learning sample. The computational effectiveness of the approach depends on the relationship between the dimensions of the three-dimensional filter, the required number of individual filters and the number of solution elements processed. The algorithm is effective where  $\gamma > 2$ , its gain in comparison to previous procedures increasing in proportion to  $\gamma$ . References 3: 2 Russian, 1 Western.  
[235-6508]

## COMMUNICATIONS

UDC: 621.391.8:621.396.669

### MULTIPLICATIVE NOISE AND ITS CONTROL IN TRANSPORT RADIO COMMUNICATIONS SYSTEMS

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 4, Apr 83 pp 8-11

GOLOVIN, E. S., docent, Leningrad Order of Lenin Institute of Railroad Transport Engineers imeni Academician V. N. Obratsova (LIIZhT), candidate of technical sciences

[Abstract] Operation of new communications equipment in the meter wave band involves difficulty in overcoming so-called multiplicative noise in receivers aboard fast moving objects such as trains. This article studies the mechanism by which this noise develops and means for decreasing its influence on the quality of radio communication channels. Objects around the communications equipment effectively reradiate meter waves so that at each point along the track the receiver will receive the direct wave from the transmitter plus several reflected waves which cause multiplicative noise. There are three main groups of methods for control of multiplicative noise: 1) Space diversity reception; 2) Methods of selecting reflected waves; and 3) Adaptive processing of fluctuating signals. The three methods are briefly described. The use of one method or the other, as well as combinations of the methods, can significantly improve reception quality without requiring an increase of broadcast power in the meter and decimeter wave band.  
[236-6508]

### EFFECTIVENESS OF INTRODUCING COMPLEX SYSTEM OF BROADCAST PRODUCTION QUALITY CONTROL TO RADIO ENTERPRISES

Moscow VESTNIK SVYAZI in Russian No 4, Apr 83 pp 40-42

PUSTOVOYTOVSKIY, A. S., chief engineer, BSSR Radio Broadcasting, Radio Communication, and Television Junction, BSSR Ministry of Communications, and SHCHERVICH, A. V., chief engineer, Minsk Radio and Television Transmitting Center

[Abstract] A complex system of broadcast production quality control in radio enterprises must be optimal or nearly so, i.e., to ensure the highest possible broadcast quality at minimum cost and with a minimum amount of documentation. The effectiveness of such a system has been evaluated on this basis, with a



view toward introducing it at the Minsk Radio and Television Transmitting Center. For this evaluation were used data on station equipment content and performance as well as on station labor distribution and personnel performance, according to specifications and records covering 1979-82. A special quality control program was instituted with a well designed organizational structure, headed by the chief engineer and broken down into precisely defined functional units in accordance with an appropriate classification and sequence chart. Implementation of this system should result in a target-oriented effort with a crop of major proposals, based on functional and cost analysis, concerning improvement of broadcast quality and reliability. Figures 3; tables 2. [224-2415]

#### INTRODUCTION OF SK2-13 MONITOR RACK FOR USE IN TRANSMITTER STATIONS

Moscow VESTNIK SVYAZI in Russian No 4, Apr 83 pp 35-36

BARANOV, B. P., senior engineer, Production Laboratory, and PIL'TSOV, V. M., engineer-metrologist, both of SUR-10 Radio Center No 7

[Abstract] Although the SK2-13 monitor rack contains the latest models of instruments for precise measurement of the parameters of a low-frequency signal, it is not used in some transmitter stations. One reason is the absence of a functional transducer for measurements at the TVES (tropopause wind-electrical station) input. Such a transducer has now been developed, combining an 6Kh6S twin triode with the high-frequency distortion (nonlinear) meter from an SK2-1 rack and with a detector matched to an S2-12 modulation meter through a resistor. The 6Kh6S tube must be connected so that the constant component of the demodulated signal will produce a positive potential at the transducer output. The high-frequency signal is picked up through capacitive voltage dividers at the feeder input during long-wave or medium-wave operation and through directional couplers at the feeders at the transmitter output during short-wave operation. The transducer has been designed and built for use as attachment to the Sk2-13 rack. It includes a TN-1.50 127/220 V transformer, an M4200 100 uA microammeter, a V1-TV2-1 tumbler switch, and a 2.5 A fuse. Figures 2. [224-2415]

#### RECOMMENDATIONS FOR REPLACEMENT OF DIODES IN YeSK 400 E AUTOMATIC TELEPHONE EXCHANGES

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 4, Apr 83 p 47

[Abstract] The editors have received a letter from communications workers on the Baykal-Amur railroad asking what can be used to replace diodes which have failed in YeSK 400E telephone exchanges. The question is answered by P. V. Anpilov of the Central Communications Station. The results of the breakdown of diodes in various points in the YeSK 400E automatic telephone

exchange are noted. It is recommended that the diodes installed be replaced by type KD109V, KD105V or KD209B Soviet manufactured diodes to improve reliability. The KD109V is most convenient for replacement, since all the leads are on one side. Replacement of selenium diodes on the central control device is a matter of special concern since their failure blocks the control device and thus puts the entire exchange out of operation. However, these diodes cannot be replaced with silicon diodes and therefore can be replaced only with identical diodes from the spare parts and tools kit.  
[236-6508]

#### NEW PRODUCTS AND PRACTICES IN TELEGRAPH SERVICE

Moscow VESTNIK SVYAZI in Russian No 3, Mar 83 pp 33-34

SIL'CHENKOV, N. M., senior scientific research worker, Moscow Division, Central Scientific Research Institute of Communications

[Abstract] A new list of indices and costs for communications product was introduced in 1982. The changes in the telegraph branch of the industry reflect new services and costs which have resulted from scientific and technical progress and the improvement of the organization of production. The new prices are intended to stimulate the development of progressive forms of communication, improving the effectiveness of telegraph work. The primary changes are as follows: 1) The differentiation between originating and transit telegrams is eliminated; 2) "Phototelegram" is replaced by "facsimile telegram"; 3) Products offered to subscribers are refined and revised; 4) New products are included in relation to the development of the data transmission network; 5) The productivity measure of transmission of newspaper columns is modified; and 6) New characteristics are used to measure the production of message switching centers. The changes introduced are described. The new products and prices more precisely reflect the actual cost and capital requirements of products, stimulating the introduction of new equipment and thus facilitating an increase in effectiveness and quality of telegraph communications.  
[234-6508]

UDC: 656.254.141

#### INTRODUCTION OF AUTOMATIC TELEGRAPH STATIONS ON THE BELORUSSIAN RAILROAD

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 4, Apr 83 pp 26-28

BORUSHKO, M. P., chief, Communications Departments, Signals and Communications Service, Belorussian Railroad, and VASKOVICH, M. D., section chief, Minsk Administrative Section

[Abstract] A discussion is presented concerned with the experience of constructing the AT-PS-PD automatic telegraph station at Minsk's communications hall, which completed the automation of telegraph communications of the

Belorussian railroad. Organization of the work and the physical arrangement of the equipment are described. An important problem as yet unsolved for improvement of the operation of telegraph communications on the network is the use of direct channels with small number of lines, for example between Minsk and Novosibirsk, between Minsk and Khar'kov and elsewhere. When these channels are heavily loaded, subscribers sometimes cannot obtain communications for long periods of time. The use of the new automated equipment should permit utilization of alternate channels through other stations. However, it is impossible in practice to connect all stations which have communications with each other into a single group. The authors therefore suggest that each administrative telegraph station be given a second number to give the network more flexibility. Tables 6.  
[236-6508]

#### IMPROVING COMMUNICATIONS WORK

Moscow VESTNIK SVYAZI in Russian No 3, Mar 83 pp 2-6

SHAMSHIN, V. A., USSR Minister of Communications

[Abstract] A review is presented of the work of the communications industry during the first 2 years of the 11th Five Year Plan. In 1982, the industry processed over 9 billion letters and money orders, a quarter billion packages, a half billion telegrams and one and one half billion long-distance telephone calls, delivered 43 billion newspapers and magazines, serviced more than 21 million local telephone subscribers, and 87 million radio receivers, more than one half of which can receive three stations. Two hundred and forty million persons, almost 90% of the population, were able to watch television. Although the industry in general worked successfully, in the first 2 years of the Five Year Plan only 37.6% of the total planned level of production for the entire 5 years was achieved. The key to doing better during the last 3 years of the plan will be improved labor discipline, better utilization of reserves and improved economies. The level of automation of work must be increased. The initiative of the communications ministries of Belorussia and Latvia in expanding independent financing is applauded and extensions to other republics are called for.  
[234-6508]

UDC: 537.533.3:537.6

CONTINUATION OF MAGNETIC FIELD FROM AXIS OF SYMMETRY INTO SPACE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 4, Apr 83  
(manuscript received 20 Mar 80; after revision 25 Mar 82) pp 772-778

UREV, M. V.

[Abstract] It is frequently necessary in the practice of designing axis-symmetrical optoelectronic systems to continue a magnetic field from the axis of symmetry into space. This method is used in order to calculate the trajectory of charged particles in rather complex magnetic systems when direct calculation of fields through currents in the windings is difficult, as well as optimization of optoelectronic systems during their synthesis. This article suggests a method which can be used for such calculations when the axial distribution is not precisely known. A number of methods from previous works for the solution of this problem are analyzed. The general algorithm suggested, based on representation of magnetic field induction components as Scherzer series and summation of these series by means of interpolation and smoothing spline functions, is described. The effectiveness of the algorithm and its implementation in software are illustrated using the example of continuation of a bell-shaped distribution and calculation of magnetic field induction components for a practical magnetic system. Figures 8; references 14: 13 Russian, 1 Western.  
[235-6508]

UDC: 621.383.8

CONTRIBUTION OF EMISSION PROCESSES TO BRIGHTNESS OF DARK BACKGROUND IN ELECTRON-OPTICAL CONVERTER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83  
(manuscript received 16 Feb 82) pp 42-44

ARKHIPOVA, T. A., BUTSKIY, V. V., MECHETIN, A. M. and SHAKHOV, I. V.

[Abstract] Thermionic and field emission at the photocathode as well as other subsidiary processes such as ionization of residual gases and feedback from the radiation shield contribute to brightening the dark background in an electron-optical converter. Here a methodology for estimating the contribution of each

emission process is proposed and the results of experimental measurements are evaluated. For convenience, the brightness of the dark background is expressed in units of photocathode illuminance and the corresponding photocathode dark-current density is determined from the integral photocathode sensitivity. In order to improve the accuracy of illuminance and current measurements for any particular emission process, it is necessary to minimize the effect of all other subsidiary processes. This can be achieved by illuminating only a small portion (5-10%) of the active photocathode surface. The thermionic-emission current can be measured either by scintillation count or on the basis of the dark-current density at low accelerating voltage. The secondary-emission current can be measured at high accelerating voltage, at which it becomes significant. The effect of optical feedback from the screen electrode can be estimated from measurement of the transmittance of its aluminum coating before assembly, and calibrating the results against the dark current after assembly and evacuation of this converter module. Measurements and estimates based on this methodology have been made for four experimental modular electron-optical converters with multialkaline photoelectrode and ZnS-CdS-Ag luminophor, at 10-12.5-15 kV accelerating voltages. The data reveal a shift of the emission spectrum toward shorter wavelengths with an increase of the accelerating voltage. They also reveal an absence of a correlation between brightness of the dark background and the count of multielectron scintillations, which indicates participation of various processes other than emission in brightening of the dark background. Figures 2; tables 1; references 7: 5 Russian, 2 Western.  
[223-2415]

UDC: 621.383.415

#### MULTITRACK-CODE SILICON PHOTODETECTOR

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83  
(manuscript received 29 Dec 81) pp 45-47

NIKONOV, B. S., REVEKINA, E. I., TAUBKIN, I. I., TRISHENKOV, M. A., FRIMER, A. I. and FROLOV, N. V.

[Abstract] A multitrack-code silicon photodetector has been developed for determining the X-coordinate of a luminous strip in optoelectronic devices and generating an output signal in the 6-digit Gray code. It contains 12 photo-sensitive elements, two per digit, each having its surface masked in accordance with the code so that  $2^6 = 64$  discrete positions of the strip can be recorded. The photoreceiver has been designed for operation with a luminous strip not wider than 0.2 mm perpendicular to the X-axis simultaneously illuminating all 12 tracks. The code mask is deposited by the planar process with p-n junctions directly on an n-Si crystal so as to prevent their shifting relative to one another caused by thermal or mechanical effects and thus ensure high stability combined with high precision. The chip is mounted in a special hermetic case with a plane-parallel entrance window. The photoelectric characteristics of this device are basically those of planar silicon photodiodes. It can operate

with a constant luminous flux or with a luminous flux modulated at frequencies up to tens of kilohertz, with a nominal operating voltage of 0.2 V, at ambient temperatures from -60 to +60°C. Its performance characteristic is linear up to  $3 \cdot 10^4$  lx from an A source. The accuracy of coordinate measurement is determined by the layout of optical and electrical components, by noise and random differences between the amplifiers, by precision and stability of the threshold device, by any asymmetry of spot illumination, by variances of dark current and sensitivity, also by sharpness of the p-n boundaries. The results of an error analysis indicate that this photodetector is suitable for measuring linear and angular displacements in optoelectronic automation systems.

Figures 3; tables 1; references 4: 3 Russian, 1 Western.

[223-2415]

UDC: 531.715.1

LASER INTERFEROMETER WITH FIBER OPTICS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83  
(manuscript received 3 Jun 82) pp 8-9

IVANOV, I. P., NESTEROV, V. V. and PERVOMANSKIY, V. A.

[Abstract] An equilateral Michelson interferometer with a laser beam and multimode fiber optics is described which also includes holographic wavefront correction for measurement of small displacements. A light splitting cube resolves the laser beam into two components. The reference beam passes through a short-focus lens, then through an optical fiber, and through a speckle-pattern forming lens to the holographic plate. The signal beam passes through a telescopic set of lenses, is then reflected first by a prism and again by a mirror which sends it to the holographic plate. Here interference of both beams takes place, two corresponding arrays of fringes are produced, and a hologram is recorded. Behind the plate are two photo-receivers and two steps, one in the path of the reference beam and one in the path of the signal beam. They pick up interference signals  $90^\circ$  out of phase and transmit corresponding electric signals to a digital transducer which reads the magnitude and the direction of displacements of the reflector prism. The width of interference fringes can be regulated, up to an infinite width, and the contrast of the interference pattern can be maximized by shifting the position of the holographic plate. Figures 2; references 4: 3 Russian, 1 Western.  
[223-2415]

UDC: 531.715.1

#### INTERFERENCE-TYPE GONIOMETER FOR CERTIFICATION OF AUTOCOLLIMATORS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83  
(manuscript received 28 May 82) pp 30-32

KOLOMIYTSOV, Yu. V. and NOVIKOVA, I. V.

[Abstract] A new interference-type goniometer has been developed, and a prototype built, for certification testing of autocollimators with high-precision measurement of level or base lengths. Its operating principle is essentially that of a Michelson interferometer. Its optical components include a large certification mirror at the center on the back surface of the test plate (whose angle of rotation is measured), two small mirrors at the two edges on the front surface of the test plate, a set of two compound adjusting compensator lenses before one of these mirrors, a set of four achromatic measuring compensator lenses before the other mirror, three 45° deflecting mirrors, an incandescent lamp, a condensing lens, a circular stop, a collimator objective, a light-splitter cube, a tripping objective, a telescopic objective, and an ocular. The performance of this goniometer is evaluated on the basis of geometrical and optical relations, with an attendant analysis of systematic errors. It has been used experimentally for certifying the commercially produced AK-025 autocollimator. Within the  $\pm 5'$  range of angles its error does not exceed  $\pm 0.07''$  at the 0.95 confidence level. Figures 3; references 5: 2 Russian, 3 Western (1 in translation).  
[223-2415]

UDC: 531.715.2

#### PHOTOMETRIC METHOD OF ESTIMATING HEIGHT OF SURFACE ASPERITIES ON TRANSPARENT PRODUCT SAMPLES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83  
(manuscript received 31 Mar 82) pp 1-3

SKRELIN, A. L.

[Abstract] A photometric method of surface roughness measurement on transparent product samples is proposed which ensures high accuracy and eliminates the need for preliminary coating of the surface with a thin aluminum or silver layer. In the case of a monochromatic light beam sent to the target surface at an incidence angle not larger than  $10^\circ$ , one measures the signals of diffusely reflected and total reflected light. Then with the test sample turned around so that the light impinges on its back surface, one again measures the signals of diffusely reflected and total reflected light. The



instrumentation consists of a spherical photometric chamber with four pinholes for light to pass through. Two pinholes are spaced apart so that the light beam entering through one, from a laser source outside, impinges on the specimen surface covering the other one at an incidence angle of  $6^\circ$ . The light diffusely reflected back into the chamber is collected by an integrating photoreceiver

behind the third pinhole. The light specularly reflected by the specimen surface either passes through the chamber and through the fourth pinhole to a quencher outside or is rereflected by a shield inside the chamber (when the latter is moved in front of the fourth pinhole) so that it also passes through the third pinhole instead and is collected by the photoreceiver behind. There is another quencher behind the test sample, for absorbing the light transmitted by the latter. The parameter of surface roughness are determined from the readings on the basis of geometrical and optical relations, with the wavelength of light as well as the transmission coefficient for the test sample and the refractive index of its material known. The method and equipment have been tested using a He-Ne laser (wavelength  $\lambda = 6328 \text{ \AA}$ ) on samples of K8 glass with various degree of surface polish, as well as on other grades of glass and optical-grade quartz glass. The author thanks M. A. Kalinina for assistance in preparation of test specimens. Figures 1; tables 2; references 11: 8 Russian, 3 Western.

[223-2415]

UDC: 535.317

#### DESIGN OF OPTICAL QUANTOMETER WITH TWO CONCAVE DIFFRACTION GRATINGS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83  
(manuscript received 26 Nov 81) pp 27-29

NEMTSOV, A. I.

[Abstract] Spectral polychromators with a concave diffraction grating and with photoelectric recording of radiation are used as quantometers for chemical analysis of materials. The basic Paschen-Runge instrument has been recently modified by addition of a second concave diffraction grating with a different period but a parallel plane of dispersion. Simultaneous operation of both gratings widens the spectral range of the instrument, while mechanical interchangeability of gratings makes it possible to adapt a quantometer for any particular band of the spectrum with a high degree of standardization. This requires that the misalignment of optical components be minimum, the lengths of the two templates be equal, the distance between the planes of the entrance slits remain invariable, the principal two incident light beams remain parallel, and the diffracted light beams not be chopped by mirror and grating frames. Design calculations based on geometrical and optical relations necessary for achieving these objectives have been programmed for a D3-28 computer. Figures 4; references: 3 Russian.

[223-2415]

## SMALL OPTICAL RANGE FINDER SM5

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83  
(manuscript received 22 Oct 81) pp 32-34

ZAKHAROV, A. I., ROSSOMAKHO, F. V., SIKORSKAYA, L. N., BEDNYAGIN, A. A. and  
EMDIN, F. Z.

[Abstract] An optical range finder is described which measures distances by the pulse method with distance-to-time and time-to-voltage conversion. It is essentially an electron-optical instrument with a GaAs radiation source and amplitude modulation of the latter by a pulse generator at repetition rates of 149,855.5 kHz for "fine" measurements or 149,855 kHz for "rough" measurements. Optical signals are detected and converted by a photomultiplier at corresponding pulse repetition rates of 1.49855 kHz or 14.9855 kHz respectively. The electronic part includes also a quartz oscillator generating a pulse repetition rate of 14,984.00145 kHz, a mixer, a phase detector, an auxiliary pulse generator for the photomultiplier, two frequency dividers, a low-pass filter, an amplifier, an amplitude detector, a threshold device, an amplifier-limiter, a corrective circuit, a counter, a digital display panel, and a micro-telephone. The optical part of this instrument includes, in addition to the modulated light source, a stop, a light-separator prism, an objective which forms a parallel light beam, a reflector, a field stop, and another objective with an interference-type light filter before the photocathode of the photomultiplier. This SM5 instrument operates with 6-volt nickel-cadmium batteries. It can measure distances of 2-500 m at least and up to 1000 m, with an rms error not exceeding 18 mm, at ambient temperatures from -30 to +40°C. Figures 3; tables 1; references: 2 Russian.  
[223-2415]

## POWER ENGINEERING

UDC: 631.37

### POWER ENGINEERING IN COMPREHENSIVE REALIZATION OF FOOD PROGRAM

Moscow ENERGETICHESKOYE STROITEL'STVO in Russian No 4, Apr 83 pp 2-4

AKHMEDOV, R. B., doctor of technical sciences, professor

[Abstract] One of the most important factors in increasing the productivity of labor in agriculture is a further increase in the energy supplied to workers. Electrification plays a revolutionary role in this effort. Documents of the CC CPSU are cited, noting the 40 to 50% increase in the electric power supplied to agriculture which is anticipated by the end of the 11th Five Year Plan in comparison with the level of 1980, with further increases planned for the period through 1990. There are reserves for further improvement of the contribution of power engineering to the food program, which include: 1) An increase in the reliability of electric power supply; 2) Expansion of electrification of primary production processes; 3) Electrification of daily rural life; 4) Decreased losses and improved conservation of agricultural products and food products; 5) Economy and increased effectiveness of the use of fuel and energy resources; 6) Use of power production wastes, including the valuable trace elements in powerplant ash; and 7) Assimilation of nontraditional and renewable power sources, including solar, geothermal, wind, small scale hydropower, biomass energy and other sources. Each of these aspects is discussed very briefly. It is particularly emphasized that the USSR's food program is a long-term strategy intended to improve the life and well-being of the Soviet people, and as such is worthy of the efforts of power engineering workers. Tables 2.  
[228-6508]

## INCREASING EFFECTIVENESS OF SPECIAL OPERATIONS AT ATOMIC ELECTRIC STATIONS

Moscow ENERGETICHESKOYE STROITEL'STVO in Russian No 4, Apr 83 pp 21-22

MAKARYCHEV, V. V., engineer

[Abstract] At present the application of anticorrosion coatings and thermal installations at atomic electric stations represents some 10% of the total volume of construction and installation work. This figure is expected to increase to 20% by 1985. At some construction sites labor is wasted by installing metal structures without preliminary applications of protective coatings. Certain manufacturing plants deliver metal structures primed with improper materials over unprepared surfaces. A number of measures are called for in order to improve the effectiveness of these special operations at AES:

- 1) Increase in the rigidity of requirements placed on planning organizations concerning the time and completeness of publication of technical documentation;
- 2) Forbidding the delivery of improperly primed materials;
- 3) Location of special shops for insulation and coating application at construction sites;
- 4) Assurance of provision of hoisting mechanisms and ventilating equipment in explosion-safe modifications for workers installing coatings;
- 5) Redesign and expansion of existing heat insulating product plants to produce highly effective heat insulating materials;
- 6) Construction of a heat insulating product plant based on Swedish equipment to produce 400,000 cubic meters of insulation per year; and
- 7) Expansion of the Gotwald experimental-mechanical plant to increase the output of special mechanisms and tools so as to decrease manual labor in these processes.

[228-6508]

## CONSTRUCTION OF CLOSED SUBSTATIONS IN MOSCOW

Moscow ENERGETICHESKOYE STROITEL'STVO in Russian No 4, Apr 83 pp 5

NESTERENKO, V. F., engineer

[Abstract] The problems of completing the construction of closed 220 kV substations in Moscow has been discussed in the press before. However, experience of constructing a number of new closed 110 kV substations in 1979-1981 on the basis of plans by Mosenergoprojekt (Moscow Planning Institute for Project Planning of Power Objects) has revealed a number of new problems. This article discusses a few of these problems: 1) Plans for construction of substations did not call for concrete slab coverage of the circular walk around the substation trench, which resulted in a downtime of 25 ton installation cranes and interruption of installation during the spring and fall mud seasons; 2) Excess sound insulation was planned, wasting money; 3) Too many windows were planned for substation buildings; 4) The plan for internal partitions in the substations

calls for the use of expensive reinforced concrete, which is unnecessary; 5) Channel sections are planned for oil filled cable guides, which is too expensive; 6) Materials planned for use in Moscow are only manufactured in Leningrad and Belorussia; and 7) The brick required for construction was not allocated by the city planning committee. The main Scientific Research Institute of Planning is called upon to bring order to the situation.  
[228-6508]

UDC: 621.311.42.001.2

#### SIMPLIFIED 500 kV SUBSTATION

Moscow ENERGETICHESKOYE STROITEL'STVO in Russian No 4, Apr 83 pp 13-15

PISMAREV, V. M., engineer, ROZENBLYUM, Ye. S., engineer, (deceased)

[Abstract] The Kazakh Division of Energoset'proyekt (All-Union Order of the October Revolution State Planning Surveying and Scientific-Research Institute of Power Systems and Electrical Networks) has developed a plan for a simplified 500 kV substation without a breaker at the 500 kV voltage side. The use of simplified line-autotransformer unit substations can save money by avoiding the use of an expensive breaker at the 500 kV end while reducing construction time. The factors which were considered in developing the plan are outlined: 1) Assurance of effectiveness of automatic reconnection device; 2) Assurance of reliable operation of autotransformer group with unbalanced loads and disconnection of line-autotransformer unit; and 3) Assurance of reliable disconnection of line-autotransformer unit in case of damage to the autotransformer group. The advantages of the design include terraced placement of equipment using standard arrangements of distributing devices, which reduces the earth work required at the substation by 255,000 m<sup>3</sup>. The use of progressive designs in the plan has decreased the construction cost by 940,000 rubles in comparison with the plan assignment.  
[228-6508]

UDC: 534.2:537.8

ACOUSTO-OPTICAL EXCITATION OF SURFACE ELECTROMAGNETIC WAVES BY FINITE APERTURE  
LIGHT BEAM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 28, No 4, Apr 83  
(manuscript received 30 Feb 82) pp 793-796

GULYAYEV, Yu. B., KURACH, T. N. and SHKERDIN, G. N.

[Abstract] A study of the problem of excitation of surface electromagnetic waves by an actual light beam of finite aperture is made in order to answer the question of possible intensities of surface electromagnetic waves produced under actual experimental conditions. The influence of an electromagnetic wave aperture on the effectiveness of surface electromagnetic excitation is analyzed in detail. At the optimal electromagnetic wave aperture a large fraction of the electromagnetic wave energy which strikes a crystal can be converted to a surface electromagnetic wave amplitude. The maximum ratio of incident wave flux utilized in the excitation of surface waves to the total energy in the incident wave is on the order of 20%. References: 3 Russian. [235-6508]

## TRANSPORTATION

UDC: 656.25:621.317.39:531.76

### RADAR RAILROAD CAR SPEED MEASUREMENT UNIT

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 3, Mar 83 pp 7-9

VERIGO, A. M., senior scientific research worker, All-Union Scientific Research Institute of Rail Transport (VNIIZhT), candidate of technical sciences, VAVANOV, Yu. V., head of laboratory, candidate of technical sciences, TENN, F. A. and PODOROV, N. A., engineers

[Abstract] The RIS-V2 radar for measuring the speed of railroad cars is a small doppler millimeter band radar made of semiconductor elements and integrated microcircuits using an avalanche diode microwave oscillator. The device is designed for use at car sorting yards in order to measure the speed of cars moving down the hump. The design of the device is discussed and a photograph and schematic diagram are presented. A power supply with a high-frequency converter eliminates 50 Hz induced currents at the input of the speed measuring circuit and improves the sensitivity of the device by 6 to 8 dB. The operation and calibration of the device can be checked remotely by use of a low-frequency oscillator. The device fits into a sealed case 510 x 195 x 170 mm in size, and is installed between tracks, 0.5 to 1 m above the rail head level.

Figures 4.

[230-6508]

UDC: 656.25:621.383

### PHOTOELECTRIC DEVICE FOR CHECKING MOVEMENT OF ROLLING STOCK

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 3, Mar 83 pp 10-13

SEM'YANSKIKH, A. I., chief, Moscow-Yaroslavl Branch, Moscow Railroad, ZHUKOV, V. I., docent Moscow Transport Engineering Institute, candidate of technical sciences, VASIN, V. K., candidate of technical sciences and FEDOSOV, V. D., engineer

[Abstract] Shortcomings of the FEU-TsNII photoelectric sensor include the possibility of a false negative (clear track) signal in case of a failure of the device. The shortcomings of the device can be eliminated by amplitude-frequency modulation of the light flux with subsequent testing of the modulated

parameter at the receiving end. The circuitry required in order to modulate and test the modulation of the light flux is described and schematic diagrams are presented. The operation of several devices utilizing this principle is briefly analyzed. Laboratory testing of the photoelectric device has shown that it performs its functions well, assuring stable optical communications at distances of up to 15 m. It continues to operate with power supply voltage variations of -10 to +15% of the nominal voltage and with external illumination levels of up to 5000 lx. Figures 8.

[230-6508]



UDC: 551.596

TRANSIENT RADIATION OF ACOUSTICO-GRAVITATIONAL WAVES

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 26, No 2, Feb 83 (manuscript received 1 Jun 82) pp 135-141

GRIGOR'YEV, G. I. and SAVINA, O. N., Scientific Research Radiophysical Institute

[Abstract] The nature of hydrodynamic disturbances is determined for the case in which a vertically moving mass source intersects the division boundary between two media at a right angle, where because of the influence of the field of gravity the equilibrium pressure and density in the two media change according to a barometric rule. It is concluded that for transient radiation in the frequency band  $\omega < \omega_g$  a caustic surface is formed. The conclusion that a caustic surface exists can also be drawn for pulsed sources by analyzing the variation in group velocity of acoustico-gravitational waves as a function of frequency. A source of mass or energy near the division boundary of two media also excites surface waves. This will be studied in a later work. Figures 3; references 10: 4 Russian, 6 Western (1 in translation).  
[227-6508]

UDC: 678.744.335

THERMOPLASTIC GLASS FOR LARGE FRESNEL LENSES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83 (manuscript received 19 Feb 82) pp 34-36

FARBEROV, A. M., KUZNETSOV, S. I. and LEPLYANIN, G. V.

[Abstract] A thermoplastic sheet material S095 has been developed for making large Fresnel lenses. Its chemical composition, based on measurement of the infrared spectrum with a UR-10 "Karl Zeiss" spectrometer, is identical to that of polymethyl methacrylate. Its properties are optical transmittance 0.91, softening temperature 90°C, glass transition temperature 96-112°C, yield temperature 185-212°C, tensile strength 650 kgf/cm<sup>2</sup>, tensile modulus of elasticity 27.10<sup>3</sup> kgf/cm<sup>2</sup>, elongation in rupture 2.5%, and impact strength 9.0 kgf.cm/cm<sup>2</sup> or better, all meeting the GOST 10667-74 specifications.

Several batches of samples were tested for those properties which determine the manufacturability and characteristics of lenses. The molecular mass, measured with a viscometer in a benzene solution, and the yield temperature were found to vary from one producer to another. Material with the lowest molecular mass was found to yield lenses of the highest quality. Figures 1; tables 3; references: 5 Russian.

[223-2415]

UDC: 681.7.07

#### ELIMINATION OF RESILIENT ANGULAR MOVEMENTS OF SUSPENDED SOCKETS IN OPTICAL TELESCOPES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83  
(manuscript received 4 Feb 82) pp 47-50

LEBEDEV, N. A. and MATVEYEV, A. V.

[Abstract] Many optical telescopes are built with interchangeable auxiliary mirrors in special sockets braced to the upper ring of the tube. Such a socket, free to be in any position relative to the optical axis of the telescope during operation of the latter, tends to deform the suspending braces by its weight so that it will rotate in its position and cause a measurement error. This movement of a socket is analyzed here on the basis of a symmetric stiffness matrix relating linear and angular displacements of the suspension to acting forces (components of the gravity force) and bending-twisting moments in three-dimensional Cartesian systems of coordinates referred to the structure. Both socket and telescope ring are assumed to be perfectly solid, rigidly clamped to the upper ends of  $n$  ( $n \geq 3$ ) legs, each leg a beam of uniform cross section, symmetrically spaced around the base circle along generatrices of the conical pedestal they form. A subsequent strain analysis of this suspension system reveals the condition for zero angular displacements. This condition, in terms of certain coefficients of the stiffness matrix, can be satisfied by a certain proportioning of the dimensions of the suspending beams and of the cone they form. A typical practical example with available numerical data illustrates this. Figures 4; references 4: 3 Russian, 1 Western.

[223-2415]

## SURFACE SHAPING WITH THIN ION BEAM

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83  
(manuscript received 16 Nov 81) pp 36-39

BUNIN, I. G., ROZHN OV, G. V., and KHODAKOV, G. S.

[Abstract] The technology of surface shaping with a thin ion beam, one which has a cross section much smaller than the dimensions of the surface, is analyzed on the basis of the physical and geometrical relations governing the process. The part whose surface is treated rotates in the machine tool at a smoothly controllable speed and the ion beam moves across the surface in programmed strokes. The advantages of a thin beam are its high degree of uniformity and elimination of the need for masks, a source of surface contamination. The various technological parameters, specifically the depth of cut, are calculated here as functions of the beam orientation angles in an axisymmetric system of coordinates. Shaping of an elliptical optical surface has been selected as an illustrative example, for which formulas are derived indicating how the technological process can be optimized. Figures 1; references 5: 2 Russian, 3 Western (1 in translation).  
[223-2415]

UDC: 681.7.067.21.013.84

## REDUCTION OF LIGHT SCATTERING IN OBJECTIVES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83  
(manuscript received 2 Apr 82) pp 4-6

MAGARILL, S. Ya.

[Abstract] The problem of parasitic light scattering in an objective is examined for the purpose of design optimization, the principal scatterers being idle optical surfaces of lenses and nonoptical surfaces of mechanical components in the path of light rays. The geometrical constraints for elimination of single scattering are established in terms of angles characterizing the path of light rays through the objective and the corresponding relation between the dimensions of lenses (diameter, curvature) and the distances from one optical plane to the next. A design procedure is outlined which implements the results of this analysis. It has been applied, for practical purposes, to the OP-1.8 objective of the "rus'" home movie projector. The construction of this objective was modified accordingly, whereupon the illuminance field was measured. Approaching the illuminance field of an ideal objective was found to be feasible, in this way, without most of the costly surface treatment. It is estimated that by proper design one can eliminate 90% of all surface varnishing operations. Figures 4; references: 3 Russian.  
[223-2415]

## COMPARATIVE EVALUATION OF SYSTEMS WITH ROTATING MIRRORS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 83  
(manuscript received 30 Dec 81) pp 19-22

KONSTANTINOVICH, K. M.

[Abstract] A general method of linearization is devised for comparative evaluation of optical scanners and compensators with rotating plane mirrors, a governing factor in the operation of such devices being a linear relation between the angle of light beam rotation and the angle of mirror rotation. A model is constructed for the most common application of such devices, namely stabilization or tracking of the light beam coordinates defining the location of a far object. The problem involves projecting the image of an object on a surface, a spherical surface being the simplest one theoretically but a plane surface being the simplest one technologically. The closeness of approximation of a spherical surface by a plane one is determined according to the rules of coordinate geometry with attendant error analysis. The results are applied to the specific case of a two-mirror system with each mirror rotating about one axis, the two axes being generally not parallel but both stationary relative to the common frame. Calculations reveal that, by proper arrangement of the two axes, it is possible to make such a two-mirror system either insensitive or more sensitive to variations of one of the two light beam coordinates, or sensitive to variations of the difference between the two light beam coordinates. Figures 4; tables 2; references 5: 4 Russian, 1 Western (in translation). [223-2415]

## OPTICAL CONTINUOUS MOTION PICTURE FILM PRINTING

Moscow TEKNIKA KINO I TELEVIDENIYA in Russian No 4, Apr 83 pp 7-13

BERNSHTEYN, N. D., All-Union Scientific Research Institute of Cinematography

[Abstract] Contact continuous printing is the most widely used type of motion picture printing. It has been used in recent years not only for production of copies but also for production of intermediate masters. Optical continuous printing is used to produce super 8 and 16 mm prints from 16 mm originals. The quality indices of optical continuous and optical step printing with reduction or enlargement are compared. It is concluded that approximately equal quality can be achieved by both methods, sometimes better than continuous contact printing. Optical continuous printing can produce copies more rapidly than optical step printing, although not as fast as continuous contact printing. Optical continuous printing greatly reduces the wear on the master in comparison with step printing or continuous contact printing. Optical continuous printing allows great standardization of copying apparatus and easy conversion of formats. Tables 1; references 12: 6 Russian, 6 Western. [233-6508]